

What is claimed is:

5 1. An integrated circuit card for use with a  
terminal, comprising:  
a communicator configured to communicate with  
the terminal;  
a memory storing:  
an application having a high level  
programming language format, and  
an interpreter; and  
10 a processor coupled to the memory, the  
processor configured to use the interpreter to interpret the  
application for execution and to use the communicator to  
communicate with the terminal.

15 2. The integrated circuit card of claim 1, wherein  
the high level programming language format comprises a class  
file format.

3. The integrated circuit card of claim 1 wherein  
the processor comprises a microcontroller.

20 4. The integrated circuit card of claim 1 wherein  
at least a portion of the memory is located in the  
processor.

5. The integrated circuit card of claim 1 wherein  
the high level programming language format comprises a Java  
programming language format.

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6. The integrated circuit card of claim 1, wherein  
the application has been processed from a  
second application having a string of characters, and  
the string of characters is represented in the  
5 first application by an identifier.

7. The integrated circuit card of claim 6, wherein  
the identifier comprises an integer.

8. The integrated circuit card of claim 1 wherein  
the processor is further configured to:

10 receive a request from a requester to access an  
element of the card;

after receipt of the request, interact with the  
requester to authenticate an identity of the requester; and  
based on the identity, selectively grant access  
15 to the element.

9. The integrated circuit card of claim 8, wherein  
the requester comprises the processor.

10. The integrated circuit card of claim 8, wherein  
the requester comprises the terminal.

20 11. The integrated circuit card of claim 8, wherein  
the element comprises the application stored in  
the memory, and  
once access is allowed, the requester is  
configured to use the application.

25 12. The integrated circuit card of claim 8, wherein  
the element comprises another application  
stored in the memory.

13. The integrated circuit card of claim 8, wherein the element includes data stored in the memory.

14. The integrated circuit card of claim 8 wherein the element comprises the communicator.

5           15. The integrated circuit card of claim 8, wherein the memory also stores an access control list for the element, the access control list furnishing an indication of types of access to be granted to the identity, the processor further configured to:

10                 based on the access control list, selectively grant specific types of access to the requester.

16. The integrated circuit card of claim 15 wherein the types of access include reading data.

15           17. The integrated circuit card of claim 15 wherein the types of access include writing data.

18. The integrated circuit card of claim 15 wherein the types of access include appending data.

19. The integrated circuit card of claim 15 wherein the types of access include creating data.

20           20. The integrated circuit card of claim 15 wherein the types of access include deleting data.

21. The integrated circuit card of claim 15 wherein the types of access include executing an application.

22. The integrated circuit card of claim 1, wherein the application is one of a plurality of applications stored in the memory, the processor is further configured to:

5 receive a request from a requester to access one of the plurality of applications;

after receipt of the request, determine whether said one of the plurality of applications complies with a predetermined set of rules; and

10 based on the determination, selectively grant access to the requester to said one of the plurality of applications.

23. The integrated circuit card of claim 22, wherein the predetermined rules provide a guide for determining whether said one of the plurality of applications accesses a predetermined region of the memory.

24. The integrated circuit card of claim 22, wherein the processor is further configured to:  
authenticate an identity of the requester; and  
grant access to said one of the plurality of applications based on the identity.

25. The integrated circuit card of claim 1, wherein the processor is further configured to:

interact with the terminal via the communicator to authenticate an identity; and  
25 determine if the identity has been authenticated; and

based on the determination, selectively allow communication between the terminal and the integrated circuit card.

26. The integrated circuit card of claim 25,  
wherein the communicator and the terminal communicate via  
communication channels, the processor further configured to  
assign one of the communication channels to the identity  
5 when the processor allows the communication between the  
terminal and the integrated circuit card.

27. The integrated circuit card of claim 26,  
wherein the processor is further configured to:  
assign a session key to said one of the  
10 communication channels, and  
use the session key when the processor and the  
terminal communicate via said one of the communication  
channels.

28. The integrated circuit card of claim 1, wherein  
15 the terminal has a card reader and the communicator  
comprises a contact for communicating with the card reader.

svb c<sup>2</sup> 29. The integrated circuit card of claim 1, wherein  
the terminal has a wireless communication device and the  
communicator a wireless transceiver for communicating with  
20 the wireless communication device.

30. The integrated circuit card of claim 1, wherein  
the terminal has a wireless communication device and the  
communicator comprises a wireless transmitter for  
communicating with the wireless communication device.

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31. A method for use with an integrated circuit card and a terminal, comprising:

storing an interpreter and an application having a high level programming language format in a memory of the integrated circuit card; and

using a processor of the integrated circuit card to use the interpreter to interpret the application for execution; and

using a communicator of the card when communicating between the processor and the terminal.

32. The method of claim 31, wherein the high level programming language format comprises a class file format.

33. The method of claim 31, wherein the processor comprises a microcontroller.

34. The method of claim 31, wherein at least a portion of the memory is located in the processor.

35. The method of claim 31, wherein the high level programming language format comprises a Java programming language format.

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36. The method of claim 1, wherein

the application has been processed from a second application having a string of characters, further comprising:

representing the string of characters in the first application by an identifier.

37. The method of claim 36, wherein the identifier includes an integer.

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38. The method of claim 31, further comprising:  
receiving a request from a requester to access  
an element of the card;

after receipt of the request, interacting with  
5 the requester to authenticate an identity of the requester;  
and

based on the identity, selectively granting  
access to the element.

39. The method of claim 38, wherein the requester  
10 comprises the processor.

40. The method of claim 38, wherein the requester  
comprises the terminal.

41. The method of claim 38, wherein the element  
comprises the application stored in the memory, further  
15 comprising:  
once access is allowed, using the application  
with the requester.

42. The method of claim 38, wherein the element  
comprises another application stored in the memory.

43. The method of claim 38, wherein the element  
20 includes data stored in the memory.

44. The method of claim 38, wherein the element  
comprises the communicator.

45. The method of claim 38, wherein the memory also stores an access control list for the element, the access control list furnishing an indication of types of access to be granted to the identity, further comprising:

5       based on the access control list, using the processor to selectively grant specific types of access to the requester.

46. The method of claim 45, wherein the types of access include reading data.

10       47. The method of claim 45, wherein the types of access include writing data.

48. The method of claim 45, wherein the types of access include appending data.

15       49. The method of claim 45, wherein the types of access include creating data.

50. The method of claim 45, wherein the types of access include deleting data.

51. The method of claim 45, wherein the types of access including executing an application.

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52. The method of claim 31, wherein the application is one of a plurality of applications stored in the memory, further comprising:

receiving a request from a requester to access one  
5 of the applications stored in the memory;

upon receipt of the request, determining whether said one of the plurality of applications complies with a predetermined set of rules; and

based on the determining, selectively granting  
10 access to the said one of the plurality of applications.

53. The method of claim 52, wherein the predetermined rules provide a guide for determining whether said one of the plurality of applications accesses a predetermined region of the memory.

54. The method of claim 52, further comprising:  
15 authenticating an identity of the requester; and  
based on the identity, granting access to said one of the plurality of applications.

55. The method of claim 31, further comprising:  
20 communicating with the terminal to authenticate an identity;

determining if the identity has been authenticated; and

based on the determining, selectively allowing  
25 communication between the terminal and the integrated circuit card.

56. The method of claim 55, further comprising:  
communicating between the terminal and the  
processor via communication channels; and  
assigning one of the communication channels to  
5 the identity when the allowing allows communication between  
the card reader and the integrated circuit card.

57. The method of claim 56, further comprising:  
assigning a session key to said one of the  
communication channels; and  
10 using the session key when the processor and  
the terminal communicate via said one of the communication  
channels.

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58. A smart card comprising:  
a memory storing a Java interpreter; and  
a processor configured to use the interpreter  
to interpret a Java application for execution.

5 59. A microcontroller comprising:  
a semiconductor substrate;  
a memory located in the substrate;  
a programming language interpreter stored in  
the memory and configured to implement security checks; and  
10 a central processing unit located in the  
substrate and coupled to the memory.

60. The microcontroller of claim 59, wherein the  
interpreter comprises a Java byte code interpreter.

15 61. The microcontroller of claim 59, wherein the  
security checks comprise establishing firewalls.

62. The microcontroller of claim 59, wherein the  
security checks comprise enforcing a sandbox security model.

20 63. A smart card comprising:  
a memory;  
a programming language interpreter stored in  
the memory and configured to implement security checks; and  
a central processing unit coupled to the  
memory.

25 64. The smart card of claim 63, wherein the  
interpreter comprises a Java byte code interpreter.

65. The smart card of claim 63, wherein the security checks comprise establishing firewalls.

66. The smart card of claim 63, wherein the security checks comprise enforcing a sandbox security model.

5 67. An integrated circuit card for use with a terminal, comprising:

a communicator;

a memory storing an interpreter and first instructions of a first application, the first instructions  
10 having been converted from second instructions of a second application; and

a processor coupled to the memory and configured to use the interpreter to execute the first instructions and to communicate with the terminal via the  
15 communicator.

68. The integrated circuit card of claim 67, wherein the first application has a class file format.

69. The integrated circuit card of claim 67, wherein the second application has a class file format.

20 70. The integrated circuit card of claim 67, wherein the first instructions comprise byte codes.

71. The integrated circuit card of claim 67, wherein the second instructions comprise byte codes.

25 72. The integrated circuit card of claim 67, wherein the first instructions comprise Java byte codes.



79. A method for use with an integrated circuit card, comprising:

converting second instructions of a second application to first instructions of a first application;

5 storing the first instructions in a memory of the integrated circuit card; and

using an interpreter of the integrated circuit card to execute the first instructions.

80. The method of claim 79, wherein the first application has a class file format.

81. The method of claim 79, wherein the second application has a class file format.

82. The method of claim 79, wherein the first instructions comprise byte codes.

15 83. The method of claim 79, wherein the second instructions comprise byte codes.

84. The method of claim 79, wherein the first instructions comprise Java byte codes.

20 85. The method of claim 79, wherein the second instructions comprise Java byte codes.

86. The method of claim 79, wherein the first instructions are generalized versions of the second instructions.

87. The method of claim 79, wherein the converting includes renumbering the second instructions to form first instructions.

88. The method of claim 79, wherein the second  
5 instructions include constant references, and  
the converting includes replacing the constant  
references of the second instructions with constants.

89. The method of claim 79, wherein the second  
instructions include references and the converting includes  
10 shifting location of the references, further comprising:  
relinking the first instructions to the references  
after the converting.

90. The method of claim 79, wherein  
the first instructions comprise byte codes for a  
15 first type of virtual machine, and  
the second instructions comprise byte codes for a  
second type of virtual machine, the first type being  
different from the second type.

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91. An integrated circuit for use with a terminal,  
comprising:

a communicator configured to communicate with the  
terminal;

5 a memory storing a first application that has been  
processed from a second application having a string of  
characters, the string of characters being represented in  
the first application by an identifier; and

10 a processor coupled to the memory, the  
processor configured to use the interpreter to interpret the  
first application for execution and to use the communicator  
to communicate with the terminal.

92. The integrated circuit card of claim 91,  
wherein the identifier comprises an integer.

15 93. A method for use with an integrated circuit  
card and a terminal comprising:

processing a second application to create a first  
application, the second application having a string of  
characters;

20 representing the string of characters of the first  
application by an identifier in the second application;

storing an interpreter and the first application in  
a memory of the integrated circuit card; and

25 using a processor of the integrated circuit card to  
use an interpreter to interpret the first application for  
execution.

94. The method of claim 93, wherein the identifier  
includes an integer.



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95. A microcontroller comprising:  
a memory storing:  
an application having a class file format,  
and  
an interpreter; and  
a processor coupled to the memory, the  
processor configured to use the interpreter to interpret the  
application for execution.

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96. The microcontroller of claim 95, further  
comprising:  
a communicator configured to communicate with a  
terminal.

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97. The microcontroller of claim 59, wherein the  
terminal has a card reader and the communicator comprises a  
contact for communicating with the card reader.

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98. The microcontroller of claim 96, wherein the  
terminal has a wireless communication device and the  
communicator a wireless transceiver for communicating with  
the wireless communication device.

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99. The microcontroller of claim 59, wherein the  
terminal has a wireless communication device and the  
communicator comprises a wireless transmitter for  
communicating with the wireless communication device.

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100. The microcontroller of claim 58, wherein the  
class file format comprises a Java class file format.

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101. A method for use with an integrated circuit card, comprising:

storing a first application in a memory of the integrated circuit card;

5 storing a second application in the memory of the integrated circuit card; and

10 creating a firewall that isolates the first and second applications so that the second application cannot access either the first application or data associated with the first application.

102. The method of claim 101, wherein the first and second applications comprise Java byte codes.

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103. The method of claim 100, wherein the creating includes using a Java interpreter.

15 104. The method of claim 101, wherein the storing of the first application is performed in association with manufacture of the integrated circuit card; and

20 the storing of the second application is performed at a later time after the manufacture is completed.

105. An integrated circuit card for use with a terminal, comprising:

a communicator configured to communicate with the terminal;

5 a memory storing:

applications, each application having a high level programming language format, and

an interpreter; and

a processor coupled to the memory, the

10 processor configured to:

a.) use the interpreter to interpret the applications for execution,

b.) use the interpreter to create a firewall to isolate the applications from each other, and

15 c.) use the communicator to communicate with the terminal.

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